WHAT IS CLAIMED IS:

1. A micromachined vertical vibrating gyroscope comprising:

a) an outer single crystal silicon assembly consisting of a plurality of arc-shaped anchors that are arranged in a circle and extended from a single crystal silicon substrate coated with an insulating annulus thereon, each of at least four anchors supporting an outer suspended flexure at the center of its inner edge and two perforated and suspended stops at the two sides of its inner edge and each of the anchors supporting a suspended comb on its inner edge having a plurality of side fingers;

b) an intermediate single crystal assembly consisting of a suspended vibrating wheel that has a same center with said circle formed by said arc-shaped anchors, and supports a plurality of suspended combs on its outer edge which have a plurality of side fingers, and connects to the outer anchors through the outer suspended flexures; and

c) an inner single crystal silicon assembly consisting of a suspended and perforated vibrating hub that has a same center with said circle formed by said arc-shaped anchors, and is divided into two electrically isolated and area-equaled half-hubs, and is connected to the vibrating wheel through two inner suspended flexures that are arranged along the central symmetric line of the hub.

2. The micromachined vertical vibrating gyroscope of claim 1 further comprising an electronic control means for driving said vibrating wheel into rotational vibration, which is adapted to be lateral comb capacitors formed from the parallel electrodes attached to the side fingers of said combs extending from said anchors and said wheel respectively.

3. The micromachined vertical vibrating gyroscope of claim 1 further comprising an electronic sensing means for detecting the rotational vibration of said vibrating hub caused by a combination of the rotational vibration of said vibrating wheel and an input angular rate, which is adapted to be two twin vertical capacitors formed from the parallel electrodes attached to the bottom of said vibrating hub and the interior top surface of said substrate respectively.

4. The micromachined vertical vibrating gyroscope of claim 1, wherein said insulating annulus has an inner portion comprising silicon dioxide and silicon nitride.

5. The micromachined vertical vibrating gyroscope of claim 1, wherein said insulating annulus has an outer portion comprising oxidized porous silicon.

6. The micromachined vertical vibrating gyroscope of claim 1, wherein said single crystal silicon includes vertical epitaxial growth single crystal silicon and lateral overgrowth single crystal silicon.

7. A method for fabricating a micromachined vertical vibrating gyroscope comprising steps of

a) providing a lightly doped single crystal silicon substrate;

b) forming a heavily doped buried layer in the substrate;

c) forming an insulating ring on the surface of the substrate;

d) performing selective epitaxial growth to form a vertical epitaxial single crystal silicon layer on the exposed silicon surface of the substrate and a lateral overgrowth single crystal silicon layer on the insulating ring;

e) conducting first deep reactive ion etching to form first trenches in the vertical epitaxial layer;

f) filling up the first trenches with an insulating material(s);

g) conducting second deep reactive ion etching to form second trenches in the vertical epitaxial layer;

h) performing anodization to convert the buried layer into a porous silicon layer;

i) removing a portion of the porous silicon layer to form suspension structures;

j) conducting pre-deposition with a diffusion source;

k) conducting post-diffusion in oxygen atmosphere to form a heavily doped single crystal silicon layer on the surfaces of the suspension structures and turn the rest of the porous silicon layer into an oxidized porous silicon layer;

l) performing low pressure chemical vapor deposition to form an insulating layer on the surfaces of the suspension structures; and

m) depositing a metal layer on the top surfaces and sidewalls of the suspension structures.

8. The method for fabricating a micromachined vertical vibrating gyroscope of claim 7, wherein said insulating ring comprises silicon dioxide and silicon nitride.

9. The method for fabricating a micromachined vertical vibrating gyroscope of claim 7, wherein said insulating ring has a width ranging from 8 to 60 micron.

10. The method for fabricating a micromachined vertical vibrating gyroscope of claim 7, wherein said vertical epitaxial layer has a thickness ranging from 5 to 40 micron.

11. The method for fabricating a micromachined vertical vibrating gyroscope of claim 7, wherein said first trenches have a width ranging from 1 to 3 micron.

12. The method for fabricating a micromachined vertical vibrating gyroscope of claim 7, wherein said second trenches have a width ranging from 1 to 3 micron.

13. The method for fabricating a micromachined vertical vibrating gyroscope of claim 7, wherein said diffusion source is $POCl_3$.

14. The method for fabricating a micromachined vibrating gyroscope of claim 7, wherein said post-diffusion is carried out in oxygen atmosphere at a temperature ranging from 900 to 1000^{0}C.